

*Phragmites*, *Hippuris vulgaris*, *Menyanthes trifoliata*, *Alisma Plantago*, *Equisetum limosum* and *palustre*, *Scirpus lacustris*, *Chara hispida*, *Nymphaea alba*, and several others.

The following are all the characteristic marks of this species that I can recollect.

*O. ærugescens*, Filaments extremely slender, opaque green, conglomerated in large toughish glutinous masses in sheltered calm situations, and nearly floating on the surface; in more open exposures broken into innumerable fragments, and suspended like cloudy flocculi in the water. Striæ numerous, at distances of about half a diameter apart from each other. Oscillatory motion often lively. Colour when dried a beautiful æruginous blue; adheres strongly to paper, exhibiting a glossy surface; filaments expanding by moisture so as to seem recent, and sometimes resuming the oscillatory motion.

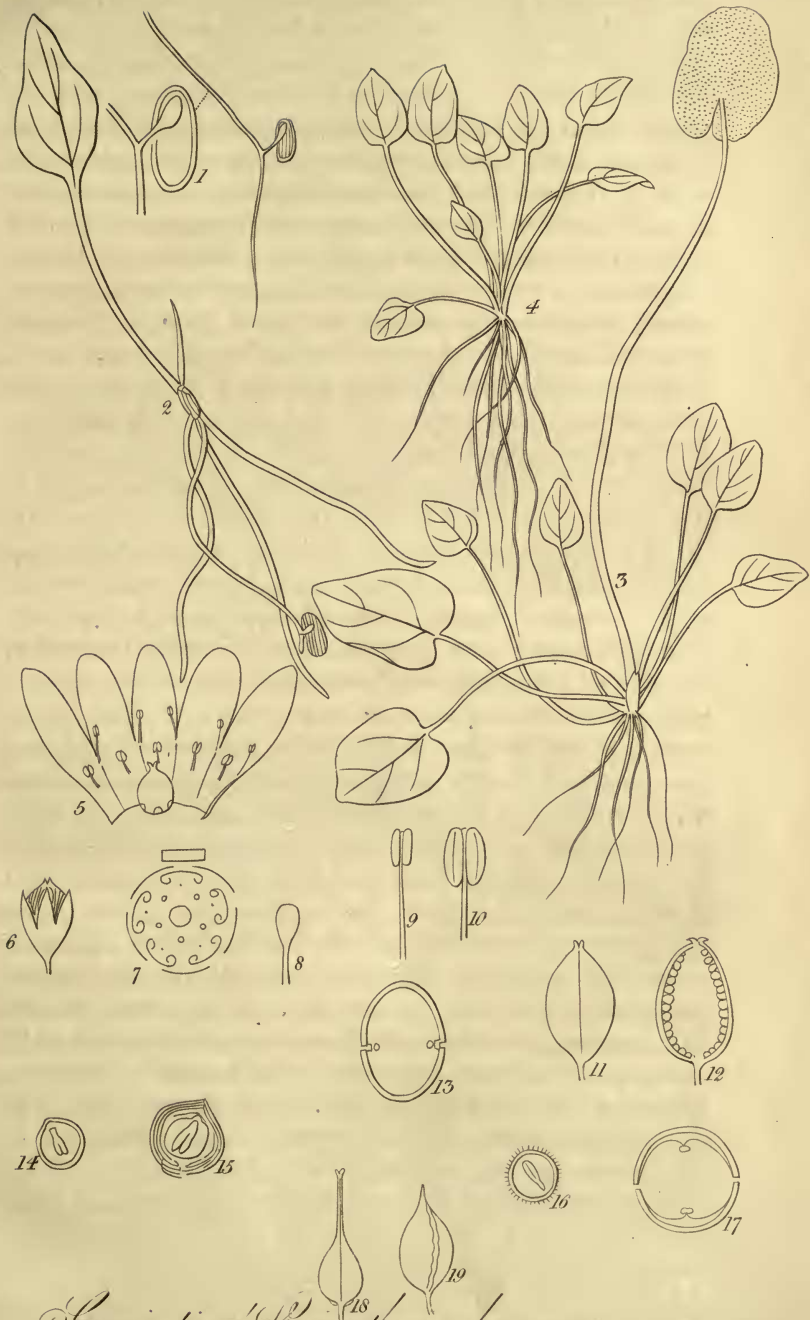
*Hab.* Lake at Glaslough, County Monaghan, Ireland.

Belfast, August 14, 1837.

II.—*Some Remarks on the Germination of Limnanthemum lacunosum.* By Dr. GRISEBACH.

[With a Plate.]

WHEN I was preparing a year and a half ago a monograph on the *Gentianeæ*, I ventured to hope that my endeavours would be furthered by the assistance of such botanists as have larger materials at their disposal, this being the spirit of a science whose followers seem to participate in that bountiful and tranquilly working principle which reigns over the Vegetable Creation. Far from finding myself disappointed in these views, I have received everywhere the most liberal, generous, and disinterested support; and am only anxious lest my labours should not correspond with the unparalleled confidence which some of the most eminent naturalists were kind enough to show me. Among the very rich collections of *Gentianeæ* belonging to Sir Wm. J. Hooker, all of which he entirely entrusted to me by sending them hither, there were germinating specimens of *Limnanthemum lacunosum*, (*Villarsia*, Vent.)



*Germination of Pinus aculeata*

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collected at Boston, North America, by Mr. Greene, which, as they seem to afford a new example of very unequal cotyledons, are the more entitled to particular investigation, since the fuller development and the petiolar inflorescence of that genus has long excited the curiosity of botanists. I was able to examine two germinating specimens hanging still to their seeds; but unfortunately neither was quite entire, though one, however, perhaps explains the other. One plant (Plate I. fig. 1.) is in a very young state; it consists of the seed, which is laterally opened and encloses a small dark body, viz. one of the cotyledons, connected with the radicle by a very short petiole; the radicle is an inch long, very slender, and descends parallel to the seed: opposite to this enclosed cotyledon, rises, in an oblique direction, a very fine white filament, almost as long as the radicle, but mutilated or torn off at its tip. In the other specimen (fig. 2.), the radicle of which is very short and evidently in an injured state, this filament is almost two inches long, white, cylindrical, and scarcely half a line in diameter, and ends here in an oblong body, out of which three cylindrical long roots descend, while a petiole with its leaf and the rudiments of a second ascend from it. Though it cannot be quite determined whether that oblong body has a foliaceous nature, nevertheless it seems certain that it embraces the base of the petiole, as well as that the roots arise from the same point: therefore I cannot but consider that body as the other cotyledon, at the top of whose petiole, the germs of the new plant originate. For, first, the filament, which I think to be the petiole of the cotyledon, stands opposite to the cotyledon, inclosed in the seed, and has that situation towards the radicle, which cotyledons always have in exogenous plants. Secondly, *Trapa* affords a similar instance of unequal cotyledons. Thirdly, the more advanced vegetation of *Limnanthemum* shows the strongest analogy with such a formation of petiolar development as that alluded to; namely, the seed and its filament being obliterated, more and more roots and leaves grow from the same point (fig. 3.), till one petiole attains a much greater length than the others (fig. 4.); this petiole, commonly half a foot high, while the rest are scarcely more than an inch, develops soon, not far from the origin of

the leaf, a new set of germs, some of which descend and form small and somewhat thick roots, of a very simple cellular tissue, while others put forth peduncles and flowers. Such a process is often repeated, for when the plant is in its full vigour and its base has become a thick rhizoma\*, as many as twenty long petioles are not unfrequently to be met with, the leaves of which float as well as the flowers, the latter rising from the upper part of each petiole, all at the same point and opposite to petiolar roots. In some other species of this genus, viz. *L. cristatum*, between the floral buds not unfrequently one large branch shoots forth which does not end in a flower, but grows laterally to a great length and produces another leaf, which again bears floral buds and roots in the same way near the top of the petiole. It may easily be conceived that the development of buds on those points is highly analogous to the origin of the young plant from the petiolar top of the long-stalked cotyledon. Besides, it seems clear enough that the formation of germs from the petiole is owing to an union of a cauline organ with the petiole, as well as of the plumule with the cotyledon in the latter case.

If we compare this germination, if correctly understood, with that of *Trapa*, we see here also one cotyledon inclosed by the nut and the young plant at a great distance from it; but here is this remarkable difference, that the inclosed cotyledon is the long-stalked one, while the other is most obliterated, and that the plant grows in the common way from the axis of both cotyledons, the radicle being the real origin of the root. In *Limnanthemum* the radicle dies soon after the development of cotyledons, and the true roots rise at another point, viz. from the petiole of the long-stalked cotyledon. This is indeed highly singular, and I know of nothing analogous to this fact; but I am also as little aware of any analogy to the further vegetation of that genus. Another resemblance to *Trapa* lies in the formation of roots from the higher parts of the stem; or in *Limnanthemum* from the petioles which perform the function of a

\* This rhizoma must be considered as the real caulis, and I cannot agree with M. A. de St. Hilaire (*Voyage au Bresil*, vol. ii. p. 413.) who takes for the stem that part of each petiole which is inferior to the inflorescence. This view is refuted by the younger plant.

stem. May not this analogy help to prove how erroneously some authors have considered those of *Trapa* to be stipules?

If we investigate more particularly the structure of *Limnanthemum*, a genus which adorns the waters of far the greater part of both hemispheres, we shall not without some interest inquire into the peculiarities of its organs. For my present purpose it seems sufficient to touch chiefly upon the structure of the seed in this genus, which certainly does not well correspond with the theory of its germination just proposed, or at least there are no characters in the seed by which the following phenomena may be foreseen. I am highly indebted to my friend Dr. Schleiden\* for an examination of these parts; as he has been for years, and with the fullest success, occupied in investigating the development of ovula; and the acknowledged precision and admirable acuteness of his microscopical researches afford the following observations a greater weight than my own inquiries, if unassisted, could do.

The question whether the *Menyanthideæ* really belong to the *Gentianeæ* may be solved more easily if we compare the essential parts of their flowers before we are biassed by a view of their vegetative organs. The *Gentianeæ* have an ovarium composed of two carpels, which bear an indefinite number of ovules at their sutures. The genera with a *placenta centralis* make no exception to this rule, the latter being combined of four placentæ, whose vessels rise from the introflexed margins of the carpella in an earlier state. The seeds have only a single testa, are antitropous, and contain a small cylindrical embryo which lies in the middle of a fleshy albumen; the latter being formed in the interior of the *sacculus embryonis*, while the nucleus is obliterated. The cotyledons in that state are oblong and somewhat thickish (fig. 14—16), and between them may be observed a thin layer of albumen, so that Mr. Brown called the cotyledons of *Menyanthes* and *Gentiana lutea* “semi-discretæ.” This structure of the seed is quite identical in the *Menyanthideæ* and in the other *Gentianeæ*; there is not the least trace of disproportion in the cotyledons of *Limnanthemum* while still in their seed, though the radicle be very slightly

\* Dr. Schleiden's interesting paper on the development of the organization in Phænogamous plants will be found in Phil. Mag. for February 1838.

bent, which I did not see in any other plant of the family. But another difference is afforded by the testa of the ripened seed, which is covered by a thick and somewhat woolly epidermis in all *Menyanthideæ*, while the testa of the *Gentianeæ* is quite simple: the epidermis of the former is often muricated, a character which seems to be very constant, and may be employed for specific distinctions. If we consider that the *Menyanthideæ* are aquatic, many of them even floating plants, we may ascribe the presence of the epidermis of their seed to their habitat; for a similar one has not been observed in the *Gentianeæ*, nor can we consider this lobe a distinctive character, as it may disappear, when either one of the *Gentianeæ* is detected growing in water, or one of the *Menyanthideæ* on dry ground. Finally, the placentæ rise, in *Menyanthes trifoliata*, from the middle of the valves, which seems to result from an union of them with the interior surface of the endocarpium, and which occurs also in many *Gentianeæ*; the seeds are commonly much larger, but in *Frasera* they are equally large: in the latter genus their number is subdefinite, and in *Villarsia ovata* it is reduced, lastly, to a single seed on each side. Finally the induplicative æstivation of the corolla affords a good character for the *Menyanthideæ* as a peculiar group of the family, being *dextrorsum contorta* in all *Gentianeæ*; but the transition of these characters takes place in those *Gentianeæ* which have a plica between the lobes of the corolla, these plicæ having also an induplicate æstivation; and, as in *G. Andrewsii*, the lobes disappear wholly by abortion: the corolla by the plicæ remaining affords the same æstivation as in the *Menyanthideæ*. So far with regard to the differences of these groups in their reproductive organs, for I know of no more than these, and I find besides strong analogies, as for instance, in the direction of the unequal sepalum being remote from the axis (fig. 7.). As to what concerns the disparities of vegetation, these depend mostly on their aquatic or terrestrial station, viz., the development of a rhizoma, and accordingly of alternate leaves (which are repeated in *Swertia*), the development of long petioles, so that the leaf may arrive at the surface of the water, and the verticillæ of leaves in *Menyanthes trifoliata* being remote from its stem for the same purpose, &c. I think an accurate examination of all these